Raising agents: sources of human social intelligence

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Abstract. This paper urges that if we wish to give social intelligence to our agents, it pays to look at how we acquired our social intelligence ourselves. Our drives and motives are innate and deeply social. Next, as children we are socialized to acquire norms and values. This motivational and group-based life is the core of our being in the real world. As a consequence, economic rationality or logical reasoning will only take agents so far when it comes to social intelligence. In order to advance our understanding of social intelligence, and to build socially versatile agents, we need to complement our attention for the 'what' and 'how' with attention for the 'why' and 'with whom'. Basic features of our social behaviour, of the kind that one sees early in the lives of children, need to be prominent. These include basic drives, such as avoidance and fear, approach and love, aggression when thwarted. They also include recognizing distinctions relevant to those drives, such as big and small, good and bad. They extend to the combination of these basic drives with basic social clues from the environment, leading agents to differentially respond to inferred attributes such as gender, age, group membership. This level of universality in social intelligence should receive our full attention. The general insights gained can then be reused in myriad implementations to specific modelling issues.

Keywords., volition, drives, social intelligence, agent-based models, levels of analysis, social science, status-power theory, culture.

1 Introduction

"Imagine a superhero and a police agent facing a villain. There is also somebody else: a girl has been taken hostage by the villain, and although the villain thinks she is just a girl, she is indeed the sidekick of the superhero, who knows her moves".

This story, in more elaborate form, is the example used by [1] that they employ to discuss their sophisticated model of social intelligence, in particular two modes of reasoning: projection (reasoning as others) and stereotyping (reasoning about others). In this paper we shall take a few steps back; it is about perception of the social world rather than about reasoning. We thus hope to contribute to the issues raised by [2] in their position paper.

Suppose you had to explain this story to six-year-old children that came from a place where the social role of police agents and girls was very different from what they are in Australia (where these authors are based). How would you explain? You

would probably start by telling them who was big or small and who was good or bad, and perhaps who was a boy or a girl. But would that answer all their questions?

These questions might very well not be of the 'what' and 'how' kind, but of the 'why' and 'with whom'. They might ask whether you knew the superhero, why the superhero was so strong, who was strongest, who was friends or family with whom, whether the girl was the child of one of the others, why there was no boy.

Indeed, children from different continents might definitely have widely different pre-conceived ideas. For instance, is a policeman good or bad? Is he 'one of us' or 'one of them'? 'Policeman' could be just another word for 'villain'. Or take the girl: does it make any sense for a girl to be a 'sidekick' of a superhero? What would a sidekick do? Is it a sort of wife, or sister, or child?

I am introducing and discussing this example here since it is from a very recent and up to date article, but I could have used any of a number of rather similar examples to point out that the examples used in AI papers tend to assume social knowledge on the part of their readers that cannot be taken for granted in the real world.

The point of using the children is that AI agents are like children, but even more ignorant, in the sense that they do not know any of the preconceived categories from any civilization. The designers have to teach agents everything about their world. There is also a difference: real children have to learn to understand the full complexity of the world, while agents typically live in a very narrowly finite world.

In this essay-style paper I explore how the comparison between children and agents can inform the design of socially intelligent agents. Learning in children is introduced. Then, the big picture is used to search for theory that can allow agents to socialize. There is a discussion that touches on levels of analysis, on norms and values, on language and embodiment. It also revisits the villain-superhero story in terms of the model primitives from the literature. A brief conclusion ends the article.

2. Raising agents

Now suppose that we wish to create more socially intelligent agents. How do children become socially intelligent? Can we raise our agents as we raise our children? In a sweeping picture, we can say that children are born with certain capabilities, and then raised by their caretakers and the wider society to bring these capacities to fruition. There are recognizable sequences in development, and they require social intercourse. A new-born is immediately driven to need things. It wants to be fed and held. As it grows up the range of needs becomes wider, but the drive to have them satisfied remains. The first thing that a baby learns is to express intentions and to respond to the intentions of others, e.g. by smiling, babbling or becoming agitated. In this way a baby can show whom it loves and whom it fears. It also develops empathy. These innate capacities must be crucial for developing so early. They even precede the development of basic motor skills.

Then, 'it takes a village to raise a child'. Every day, while attempting to satisfy its drives, the child is subjected to endless interactions and also performs millions of experiments by behaving in a certain way and receiving feedback. This is how it

learns which behaviours are rewarded and which are punished, which distinctions are meaningful (such as big/small, good/bad, boy/girl, clean/dirty) and which categories or groups of people should be treated differently.

It is thus that our children acquire a mental architecture of social life that underpins and precedes their reasoning in any particular situation. The question now becomes whether we can re-use some of this in developing socially intelligent agents. Ideally, such social intelligence could be re-used for all kinds of applications, notably virtual agents and robots. Naturally, such applications would require supplementing social intelligence with other capacities, such as sensory skills, language skills and motor skills. All this is in accordance with child development.

From child to agent

The child-agent metaphor could be pursued in various ways; one could try for instance to mimic the years-long inductive learning process. Here we shall take the simpler stance that we might socialize our agents in one fell swoop by inculcating drives, as well as a full-fledged architecture of the social world, in their minds. Which concepts and theories can help us here? These should be so general that we could build our models of social intelligence on them without running into the issue of assuming all kinds of preconceptions. They should build on a limited number of primitives that the agents would have to be taught, such as power, fear, aggression, relationships, and love. Selecting which primitives to use and designing a meta-model containing them is a crucial task that the theories should help us with.

In conclusion, we can look for theory at this level of generality.

2 Basic theory for social intelligence

So many disciplines exist in the social sciences, and so many theories in each of them, that it might at first seem a rather haphazard, if not hopeless, task to select theories that can help us model socially intelligent agents in the generalist sense defined above.

Are there criteria by which to select theories? We propose the following:

- Distinguish levels of aggregation that have shown in practice to be relevant to social life and select theories at the most important levels;
- Select theories that are sparse, so that they do not complicate but simplify the modeller's life;
- Use theories that have proven their real-world relevance;
- Use theories that can happily be combined into a coherent meta-model.

Levels of analysis could be, in order of ascending universality: brain circuitry, individual psychology, social psychology, sociology, cross-cultural psychology, biology. In addition, evolutionary and developmental approaches could be used.

This paper will limit itself to four levels: the individual, the group, the sociological and the cultural level. I believe these levels to be essential, and a good starting point. The text will introduce a theory at each of these levels that can be used for modelling

agents that are socially intelligent in a generic way. Other theories could be used; the theories mentioned here are ones I have used in previous work [2,10,14,15,18].

2.1 Individual motivation

For the design of agent systems that delve into the psyche of individual agents, theories of human motivation may help.

Some of these have great face validity but not such a lot of empirical support. This might be due to two things. First, there is the simple task of interpretation: recognizing concepts in real-world events. Take any social event seen by several people and it is likely they have a different interpretation. Secondly, there is the fact that in reality there are always such a lot of factors impinging on individuals that the signal caused by individuals' motives gets drowned in the noise of other influences. This makes it hard both to define motives and to recognize their operation. This state of affairs characterizes the theories on motives by McClelland, on human needs by Maslow, and on emotions by Frijda. All three have found widespread use, could be really useful for agent designers, but could be attacked on empirical grounds by those who want statistical proof.

McClelland [3] took children's stories from many countries and carried out content analysis on basic motives of the characters in the stories. He distinguishes four motives: achievement, affiliation, avoidance and power motive. McClelland did analyses at country level that interestingly show correlations with Hofstede's dimensions of culture, e.g. a masculine culture correlates with more achievement motivation in the characters (Geert Hofstede, unpublished). McClelland himself is mainly concerned with the level of the individual.

Maslow [4], a clinical psychologist, found that his patients would be traumatized in recognizable ways depending on deprivations they suffered on a limited number of basic needs that he termed physiological, safety, love and belonging, esteem, and self-actualization. These come close to the 'drives' that I assumed in children.

Frijda [5] spent his career studying human emotions and the basic tendencies underlying them. Among these, approach and avoidance are key, as well as positive and negative affect.

It does not take heavy intellectual gymnastics to see these three theories as cutting more or less the same cake in different ways. Each could be used for agent design.

McCrae's trait theory [6] delves less deep than these theories, but takes a more empirical point of view. Studies in many countries confirm the existence of five dimensions: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism ('OCEAN'). It's not about motives but about the behaviours that result from whatever factors that might cause them, including motives. The theory has received good empirical confirmation across many cultures. Average personality varies across culture [7]. There might be a sixth trait, 'dependence on others', that becomes apparent if Asians are compared to Western people [8].

Depending on a simulation's aim, designers need not be too concerned about the precise differences between agents at individual level, as long as the individuals have basic human drives and heterogeneity.

What about norms and values? Values, as I use the word, are different from drives and motives. We are born with drives, while we learn our values from others. Values, therefore, belong to the realm of either social identity or culture. Much the same holds for norms. Both concepts will be discussed after all levels of analysis have been introduced.

2.2 Social identity

There is overwhelming evidence [9] that people, from wherever in the world they might be, are prone to dividing the social world into 'we' and 'they', and that this is a process that happens at many scales of time and intensity. We have a family, a people, various groups of very different persistence and closeness. We tend to commit to those groups that will provide us with social status.

It is surprisingly easy to call social identities into existence. At the most ephemeral level we can don yellow and red shirts and immediately change our behaviour accordingly. People understand group boundaries and commit to roles in groups. Infants tend to consider everyone as a group member, but are quick in seizing cues to the contrary from their caretakers. Such capacities would much benefit virtual agents.

Social identity has been used for agent design [10] but the search for good models is by no means finished [2, 11]. The implicit default in agent world so far is that there is just one group; social identity is usually simply disregarded. In a simulation that includes agents with norms this becomes problematic. Norms vary by group. Adherence to, or violation of, norms are typically used by people as social signals, not just about the validity of these norms, but also about group membership [12] or status.

2.3 Sociology

Sociology can tell us things about the dynamics of social life, generalized across people. They shed light about what motivates people to engage in social interaction.

A theory that grants people their basic drives, allows for individual deliberations, and that is sparse, generic across all people, and sociological, is status-power theory by Theodore Kemper [13]. I believe this theory to be eminently suitable for agent world design. It posits that people are driven to both claim and confer status on one another in a context of reference groups; thus it sits well with social identity theory. Only if someone receives less status than they feel they deserve, they will be tempted to resort to power moves. Status and power moves can take thousands of forms, discussed at length by Kemper. A brief overview of Kemper's theory is presented in [11].

Backed up by years of study as well as by empirical support, Kemper posits that people are driven to both claim status for themselves and confer status on one another. His concept of status is very generic and includes what is usually termed love as well as what is usually called esteem. Hence Maslow's 'love and belonging' and 'esteem' can be conceptualized as status in reference groups without much trouble. Belonging could translate to being accepted in a group by being given the signs of status that

signify acceptance. Love translates to an agent being driven to voluntarily give love, a form of status, while esteem does the same for respect, another form of status.

Kemper himself stresses the unifying potential of status-power theory. He describes derivations for theories of emotions, ideas, social identity, and motivation, among others. He also indicates that much of what we do could be seen as a cover-up of underlying status-power motivations, to which there is a coherent system. It is that underlying system that can be the focus of agent-based models.

Kemper's work has not been used in ABM before [11]. A related theory, smaller in scope of application but more detailed, that has recently been used in an agent-based model is Affect Control Theory by US sociological social psychologist David Heise [14]. Heise posits that people trade 'affective meaning' during group meetings. Affective meaning effectively consists of a perceived status conferral element ('evaluation', ranging from pleasant to unpleasant) and a power element ('potency' ranging from powerful to powerless), as well as an 'activity' element that is less easily interpreted in Kemperian terms. Heise used transcripts of US jury meetings in which the utterings had been classified according to 'Interaction Process Analysis', which distinguishes classes such 'shows solidarity', 'disagrees', 'shows antagonism'. With his agent-based model, Heise was able to convincingly reproduce the distribution of actions by participants, including gender patterns.

2.4 Cross-cultural differences

This level describes the social issues that societies contend with and have solved each in their own way. This concerns ways of dividing social goods that people are driven to strive for: leadership, status, power, love and belonging. It operationalizes the ways in which agents, or people, live in different worlds. Here 'worlds' can refer to societies our countries, or other larger groups that exist from birth. There is now a vast body of evidence that down to the most basic psychological phenomena, such as the relative importance of the basic drives and distinctions, behaviours are culture-specific [15]. People from different parts of the world do not live for the same things; culture resides in their hearts, that is, for our present purposes, in the parameters of their basic architecture of social life.

While expats, travellers, and people in international jobs tend to know about deep-seated cross-cultural differences from experience, hard empirical evidence for this is scarce because it requires uniting disciplines that have mostly operated separately. When aggregated to country level, psychological theories show correlations with dimensions of culture. The links indicated above between McClelland's motives and Hofstede's dimensions, as well as McCrae's traits and Hofstede's dimensions [7], testify to this. As a consequence, it just does not make sense to build an agent world of any sophistication without specifying the cultural setting in which it applies.

It is here that our six-year olds will very clearly be distinguishable into those who know the categories, roles and relations implied by the superhero – villain story, and those who interpret these concepts in a way different from what the storyteller implied.

The level of culture is difficult to implement and to discuss. It is difficult to discuss, because most people have no experience of cross-cultural differences at a level so conscious that they can make sense of other cultures than their own from these other cultures' perspective. People who have only been immersed in one culture in their lives are like fish that have never lived on land. The level of culture is difficult to implement, because how can you ask a fish to model the water, let alone the land?

At the same time this level is vital. Our cultures are the unwritten rules according to which we self-organize our societies. They contain unconscious, shared values to which people tend to adhere. At this level there is only little cultural change; most of the change that we observe from hype to hype, or from year to year, happens as pattern caused by cultural rules and values. Some of that rapid change in practices is captured in unspoken norms that are commodities around which group membership issues are played out, for instance what to wear to be considered important in a certain group, or how to greet various categories of people to show appropriate respect. These changes in norms affect practices all the time, but leave the underlying values, such as what level of respect to grant to certain categories of people (parents, strangers, …) when one meets them, comparably unaffected [16]. Such norm changes, then, function as signifiers of social identity. They are waves rippling the sea of culture, the deep levels of which are unaffected. Social identities can change on a scale of days or years, without necessarily altering the cultural value system of the society in which they occur. In consequence, agents with cross-cultural skills should distinguish social identity from culture.

Models of culture that allow implementing agent worlds with different cultures have to be comparative ones. There are a number of these, with different empirical bases and different track records when it comes to describing or predicting society-level phenomena. The theory that has proved most useful so far is the one by Hofstede, including additions made by others in recent years [16]. It has stood up to many replications by many people, shows continued validity over the years [17] and is extensively used both in research and in practical disciplines such as management and organizational behaviour.

3 Discussion

Choice of level of analysis

Readers may have appreciated that in order for a model to make social transactions happen between agents, some kind of sociological theory cannot be avoided. The agents need a motivational system based on a limited set of innate drives. I have not found any theory that could be an improvement on Kemper's status-power theory in this respect. Kemper's work is also open-ended enough to allow, even require, combination with other theories. Social Identity Theory can be combined with the reference group element of Kemper, since his reference groups are social identities in the mind of an observer. This level needs to be present almost in any case.

In order to pretend at being generalizable beyond a single instantiation, the level of cross-cultural modelling needs to be present, as illustrated by the villain story and its interpretation by children from all over the world.

The level of the individual could be simplified to include only basic drives as per Maslow / Kemper, as well as distributions of variation so that agents are heterogeneous. Actual personalities are not necessarily needed.

Proof-of-concept implementations of agents that operate according to Kemper's ideas in a cross-cultural context are described in [18-20]. A strong feature of these agents is that depending on their culture they can reach different judgement regarding the appropriateness of behaviours.

Norms and values revisited

Norms and values are essential concepts for social agents [21, 22]. Unfortunately, their use can cause confusion before levels of analysis have been discussed. This is why I'll return to them at this point in the paper.

The term 'values' has been used at various levels of analysis. Many authors would classify values as attributes of individuals, whereas others see them as shared attributes of the members of a culture; in fact Hofstede [16] calls values the unwritten rules of the game of a society. Values direct our drives. A drive for social status will lead agents to behave very differently depending on the values that prevail in the groups to which they affiliate.

To social reality modellers, values will give a mapping from possible agent actions to their social correlates: killing a villain is 'good' or 'bad' for instance. This mapping from specific to its relational meaning in a social intelligence meta-model could be implemented as a 'counts as' function [23]. So 'killing a villain' is one way to achieve a certain relational result; in this case a way to achieve more social status among the Good Guys. However, under a different value system, or perhaps under the same value system but if one were a member of the villain's group, killing that villain could be a reprehensible crime.

For the term 'norm', all agree that a norm is shared by people. n real life norms are routinely used to mediate membership of social identity groups; one is urged to 'behave', or to 'be a Good Boy'. Many modellers use norms as a prescription for behaviour, others argue that one can deviate from a norm, and some note that there can be different kinds of norms: ideal-types of behaviour, versus actual behaviour. For instance, the ideal might be not to kill, but killing the odd villain does happen. Actually this can perhaps be better explained in terms of group identity: the norm for not killing only holds between members of one's group.

As mentioned above, the difference between values as discussed here at society level, and norms at the level of social identity, is that the latter are more changeable; one could even say adherence to, deviation from and creation of norms are used as commodities to mediate group membership that have the effect of preserving value systems. As Blaise Pascal formulated it: "Plus ça change, plus c'est la reste la même chose." An analogous saying in English is "we watch the ripple, and take the lake for

granted". The more norms change, the more they perpetuate the value system that underlies their dynamics.

A rich model of social identity will no doubt require implementing norms as well as values. The former will be linked to specific agent behaviour at the level of social identity through counts-as logic [24]. The latter will be linked to the cultural level.

Language

A recurring controversy in AI is how much of human behaviour one can understand without language. A full article could be devoted to this, for which the present article is not the place. Briefly, the positions are as follows. On one side are those who maintain that humans language makes humans different in kind from animals; this holds e.g. for Michael Tomasello. On the other side are those who stress the similarities across creatures, finding only differences in degree between humans, bonobos, great whales, etcetera. This includes for instance Frans de Waal.

Historically, the strength of the first position has been on the decline for centuries, since times when not even all human beings were granted humanity [25]. In fact there could be a social identity issue at stake: are we prepared to consider ourselves as similar to apes, for instance? Each categorical barrier between humans and other creatures used up till today has been discarded on closer scrutiny. This includes language use. All kinds of creatures have been found to be remarkably good at conveying social intention, without using full-fledged languages of the kinds I'm writing this article in.

In conclusion, it seems wise to adopt the position that, as far as social intelligence goes, language is a means of expression, not a source. This is in effect the position taken by Heise [14] in the agent-based model discussed earlier and by myself in [11].

Embodiment

How much change would there be in the need for social intelligence depending on whether it was meant for a robotic application, a realistic 3-D virtual world, or a simple grid?

There is no doubt that embodiment changes many things. One has to link the physical world to the social. If the superhero wants to kill the villain, he needs a heavy, solid object, such as a stick – is one to be found in the environment? In a non-embodied world there would not be a stick, nor a dexterous hit that kills. That would not change the intention though, and the superhero's skill could be modelled by a chance of succeeding in killing the villain.

The argument in this paper is based on [1], in which there is no embodiment. My position is that it should be applicable to any world. The individual differences, social identities, status-power motives and cultures are given links to the physical reality, which adds enormously to complexity and required computational power bot does not in any way invalidate the social intelligence needed. Embodiment adds many things but removes none.

The example revisited

If we modelled the villain-superhero story using these basic theories, what could we get? Of course this is a subjective matter, if only because anybody, including the present author, reads with a subjective lens influenced by individual experience and personality, group affiliation and social identity, and culture (one academic Dutch reader of the manuscript commented that she suspected the superhero might be a mafia boss, hence a Bad Guy, and the sidekick a gullible chick, hence good but stupid – so she introduced another distinction, between smart and stupid). The attempt is to be as dispassionate as possible about it.

- Individual: The characters are all archetypes, so individual personality is not needed, and general assumptions about relative importance of drives are made that derive from the cultural level. In the villain story for instance, the social role of power is essential.
- Social identity: There are two group identities: the Good Guys, and the Bad Guys. Part good, part bad has no place. The villain is the only Bad Guy. There are no family relations. The superhero and the girl are friends. The sexual domain is implicit – they are probably sexual partners too – but kept outside the story.
- Sociology: When it comes to power, the superhero is the most powerful, followed by the villain, girl and police officer, perhaps but not certainly in that order. When it comes to status claims, the villain claims superhero status (maximally high) while the girl only claims ordinary status for a young girl (implicitly sexually attractive). Talking about status conferral tendencies, the superhero and girl are friends and will always protect one another from the power of others.
- Culture: At the level of culture, it is the case that power dynamics are more important than status dynamics. All protagonists are ready to use power against one another, in a violent manner. None respect others' status to the point of obedience, i.e. to the point of refraining from power use voluntarily. We thus implicitly have a masculine, indulgent culture with a smallish power distance.

This defines our situation at the four levels of analysis. Our agents would need beliefs and knowledge about the above. Many of those would be of a generic kind, e.g. what does it mean to be a girl as opposed to a boy, and what behavioural intentions can be used with others depending on relative status and power.

Note that like Felli et al.'s model [1], it does not yet say anything about the more proximate aspects of modelling: personalities, capacities, the physical world; it could quite conceivably be paired with such a system though.

Felli et al.'s article contains some elements that could be developed in the direction of this paper's concepts. Their stereotypical reasoning, notably, could be elaborated in that direction.

4 Conclusions

This paper argued that, like children, socially intelligent agents need to be raised. They need a socializing process if the ambitions of modellers of social intelligence are to build generically intelligent agents. These modellers then need to tackle basic 'why' and 'with whom' elements of social behaviour, similarly to the way children learn about the social world. When these basics are modelled in satisfactory ways, the generic models can be used by others to build their cognitively sophisticated, situationally instantiated, 'what' and 'how' logics. Without the generic level, the field will be left with a body of disparate applications.

This is a way of saying that the field of modelling social intelligence would profit from adopting some elements from the evolution, as well as the ontogenetics, of social intelligence itself. Be social first, intelligent next. In terms of level of analysis, start with the big picture, not the details. These two elements may prove fertile directions for development of our field.

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